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(54) Open roof construction for a vehicle

(57) An open roof construction for a vehicle having an opening (2) in its fixed roof (1) comprises a stationary part to be fixed to the roof with guide rails (6) extending in the longitudinal direction of the open roof construction. A panel (3) is adjustable between a closed position, in which it closes the roof opening, and an open position, in which it releases the roof opening at least partially. An operating mechanism (4) for adjustably supporting the panel (3) includes a driving element (18) capable of movement in said guide rails (6) for driving a vertically adjustable part (16) having a guide head (15) present thereon. The guide head (15) engages

round a link plate mounted under the panel (3), which is provided with a guideway in the form of link ribs (11) projecting from the link plate on either side thereof. The guide head is provided with two opposed grooves (20) being open in a direction towards each other, which function to receive the associated link ribs (11). The grooves (20) taper off towards their lateral openings, at least on the upper side, in such a manner that each link rib (11) fits therein with some play at some distance from the lateral opening of the associated groove (20).

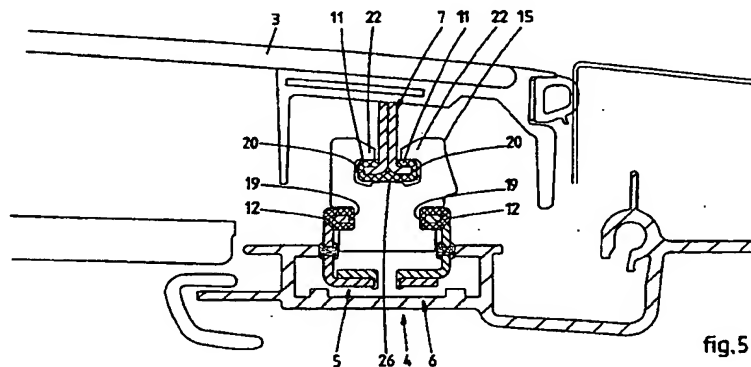


fig.5

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## Description

**[0001]** The invention relates to an open roof construction for a vehicle in accordance with the preamble of the independent claims.

**[0002]** Open roof constructions of this kind are known in various versions thereof.

**[0003]** The object of the invention is to provide an open roof construction which embodies an improved construction of the guide head.

**[0004]** In order to accomplish that objective, the invention comprises the characterizing features as defined in one or more of the independent claims. Advantageous embodiments of the invention constitute the subject matter of the subclaims.

**[0005]** The invention provides a guide head for the guideways which is remarkable for a smooth movement of the guide head along the link ribs. The engagement between guide head and link ribs allows minor misalignments without this leading to an accumulation of shearing forces. Production tolerances can be increased without this leading to undesirable play or endangering the functioning of the mechanism in any other manner. In case of incorrect alignment of the link ribs in the longitudinal direction of the panel, negative play will develop, which will quickly lead to in the required running fit as a result of the use of plastic material. Shearing forces are more precisely determined and wear characteristics are improved. The wear-in times are reduced.

**[0006]** The invention will now be explained in more detail with reference to the drawings, which schematically show an exemplary embodiment of the invention.

Fig. 1 is a longitudinal sectional view of the embodiment of the open roof construction according to the invention, showing the closure element in an open ventilating position.

Fig. 2 is a larger-scale perspective view of an operating mechanism on one side of the open roof construction of Fig. 1, showing the closure element in the closed position.

Fig. 3 is a perspective, exploded view of the operating mechanism of Fig. 2.

Fig. 4 is a larger-scale view, partially in cross-section, of the open roof construction of Fig. 1 along line IV-IV in Fig. 2.

Fig. 5 is a sectional view corresponding to Fig. 4 of an alternative embodiment of the operating mechanism of the open roof construction according to the invention.

**[0007]** The open roof construction as shown in the drawings constitutes the subject matter of further copending patent applications of the same date, whose contents are incorporated herein by reference thereto.

**[0008]** The drawings show a fixed roof 1 of a vehicle, such as a passenger car, which is provided with a

roof opening 2 for receiving an open roof construction. The open roof construction includes a closure element 3 for selectively closing or at least partially releasing the roof opening 2. In this embodiment the closure element 3 is a rigid panel, in particular a transparent panel of glass or plastic material, but also other closure elements such as slats or a flexible cover are conceivable. In the illustrated embodiment a sliding-tilt roof is used, wherein panel 3 can be moved from the closed position in roof opening 2 (Figs. 4, 5), on the one hand to an upwardly and rearwardly sloping ventilating position (Fig. 1) and on the other hand downwards (Fig. 5) and subsequently rearwards to a position under the fixed roof 1. Also other embodiments are possible, however, such as a spoiler roof or a tilt roof or the like.

**[0009]** In order to enable the movements of panel 3, panel 3 is fitted with an operating mechanism 4 at both edges extending in the longitudinal direction of the open roof construction, which operating mechanisms each include a link slide 5 in this embodiment, which is slidably accommodated in a guideway of a guide rail 6. Said guide rail 6 is mounted on or forms part of a stationary part (not shown), for example a frame, which is attached to the fixed roof 1 of the vehicle. The guide rails 6 extend along the longitudinally extending edges of the roof opening 2 and possibly rearwards thereof.

**[0010]** Part of the operating mechanism 4 is made up of a link 7, which is attached to the underside of panel 3, near the respective longitudinal edge, and that to a stiffening frame 8 thereof. At its front end link 7 is fitted with a sliding shoe 9, which is slidably accommodated in associated grooves in guide rail 6, and which also functions as the front hinge for panel 3. Link slide 5 comprises two pairs of sliding shoes 10, which project laterally and which guide link slide 5 upon its movement in vertical direction in guide rail 6.

**[0011]** Both link slide 5 and link plate 7 include guideways in the form of laterally projecting ribs 11, 12, wherein ribs 11 are formed on the lower edge of link plate 7 and extend away from each other, whilst ribs 12 are formed on the upper side of vertical walls 13, 14 of the link slide and extend towards each other. Link slide 5 and link plate 7 are formed of die-cut and flanged metal plates. Link ribs 11, 12 are formed thereon by encapsulating flanges formed on the edge of the metal plates of link plate 7 and link slide 5 in plastic by means of an injection moulding technique. A guide head 15 is in engagement with all ribs 11 and 12, and to that end it engages between the vertical walls 13, 14 of link slide 5 and round link plate 7. The interspace between the ribs 12 of link slide 5 is larger than the spacing between the outside surfaces of the two ribs 11 of link plate 7, so that link plate 7 can at least partially be accommodated between walls 13, 14 of link slide 5 in a lowermost position of panel 3.

**[0012]** Guide head 15 is formed on the free end of an arm 16, which is pivotally connected by means of a pivot 17, to a driving slide 18 (Fig. 1), which is drivingly

connected to a drive unit, such as an electric motor, a hand crank or the like, via a pressure-rigid driving cable or the like. By moving the guide head 15, which acts as a wedge between link slide 5 and link plate 7, with respect to guideways 11, 12, link plate 7 and thus panel 3 will be pivoted about pivot 9. Link slide 5 is stationary during said pivoting. In the lower pivoted position of panel 3 the driving slide is locked in position with respect to link slide 5, after which the entire operating mechanism 4 and panel 3 will move rearwards as one unit upon further rearward movement of the driving slide.

**[0013]** The construction of the guide head, which is preferably made of aluminium, is clearly shown in Figs. 3 and 4. Guide head 15 comprises a lower portion, which extends between vertical walls 13 and 14 of link slide 5 and which engages ribs 12 of link slide 5 from the inside. To this end, guide head 15 includes a pair of opposed grooves 19 facing away from each other, in which the ribs 12 can be slidably accommodated, so that guide head 15 can slide along ribs 12 and follow the path defined by ribs 12. The upper part of guide head 15 is adapted for engaging round the ribs 11 of link plate 7, and to that end guide head 15 includes two opposed grooves 20 facing towards each other, whose bottom walls continue via a central portion 21, whilst the upper walls of grooves 20 are formed by cams 22, which leave a space between them for passing link plate 7.

**[0014]** As is shown in Figs. 1 and 3, the grooves do not have straight upper and lower walls in their longitudinal direction, but the upper and lower walls of grooves 19 and 20 diverge widely from a central portion. Thus the ribs 11 and 12 can be received in grooves 19 and 20, respectively, at different angles, such that there is no play in at least one location in grooves 19, 20, which location can vary in dependence on the angle between guide head 15 and the rib 11, 12 in question. Also the height of the ribs 11 and 12 can vary along the length thereof in dependence on the angle which the guide head 15 includes with the ribs 11, 12 in question at a specific location. The upper and lower surfaces of ribs 11, 12 extend substantially horizontally in transverse direction.

**[0015]** Fig. 4 furthermore shows that the upper wall of the grooves 20 and the lower wall of cams 22 does not extend horizontally in transverse direction, either, but slopes upwards from the lateral opening of grooves 20, in this case at an angle of approx. 2 - 10 with respect to the horizontal. Also the bottom walls of grooves 20 slope slightly upwards from central portion 21. The height of grooves 20 is thereby such that ribs 11 are accommodated in grooves 20 with some play in vertical direction at some distance from the lateral opening. In order to prevent rattling of guide head 15 round ribs 11 and 12, a spring element 23 is provided, which includes a central lip 24 and two outer lips 25, which are interconnected and which consist of curved parts of spring steel. Central lip 24 is positioned between the central portion

21 of guide head 15 and the underside of ribs 11, whilst the outer lips 25 is positioned between the respective upper wall of grooves 19 and the upper side of ribs 12. The convex portion of lips 24, 25 abuts against the respective rib 11, 12. The spring force eliminates any play between guide head 15 and ribs 11, 12, whilst a certain tolerance is provided by the manner in which ribs 11, 12 are accommodated in grooves 20, 19.

**[0016]** In particular in the case of link plate 7 a certain slope of link plate 7, for example caused by a varying convexity of the closure element 3, is allowable on account of the oblique upper walls of grooves 20 and the space at the lower side of grooves 20 and the sloping lower walls thereof. Also in lateral direction sufficient play is present between ribs 11 and grooves 20 so as to offset any tolerances. According to the invention larger production tolerances are allowable without affecting the functioning of the operating mechanism. Also when the ribs 12 do not run entirely synchronously to link slide 5 in longitudinal direction, for example due to a slight shift of the two parts of which the link slide 5 is built up, this can be offset without any problem, without excessive frictional forces, by the guide head. A factor that plays a role thereby is that the slope of the ribs 12 with respect to the guide rail 6 is not very large, so that a movement in longitudinal direction of the two ribs 12 with respect to each other will not result in large differences in height in a specific cross-section.

**[0017]** Fig. 5 shows an alternative embodiment of the open roof construction according to the invention, wherein spring element 23 has been left out and an elevation 26 has been formed in the central portion 21 of guide head 15, which elevation presses against the underside of ribs 11 and against which the underside of ribs 11 can abut at slightly varying angles so as to offset any obliqueness of link plate 7. Due to the construction of ribs 11, 12 and guide head 15, a rattle-free guidance without excessive frictional forces, with guide head 15 being worn in quickly, can be achieved also in those case where no spring element 23 is used. This is made possible by the line contacts and the negative play between ribs 11, 12 and the guide head. The ribs are preferably made of POM with molybdenum sulphide as an additive, which is conducive to smooth running.

**[0018]** The invention is not limited to the above-described embodiments as shown in the drawing, which can be varied in several ways without departing from the scope of the invention.

**[0019]** Thus the driving element can also be implemented with other types of open roof constructions, such as tilt roofs and spoiler roofs, louvred roofs and the like. In the case of tilt roofs, for example, the link slide may be stationary and actually form part of the stationary part of the open roof construction.

## Claims

1. An open roof construction for a vehicle having an

opening (2) in its fixed roof (1), comprising a stationary part to be fixed to the roof, which includes at least one guide rail (6) extending in the longitudinal direction of the open roof construction, an adjustable closure element (3) supported by said stationary part, which is adjustable between a closed position, in which it closes the roof opening, and an open position, in which it releases the roof opening at least partially, as well as an operating mechanism (4) for adjustably supporting a vertically the closure element (3), which operating mechanism includes a driving element (18) capable of movement in said guide rail for driving a vertically adjustable part (16) having a guide head (15) present thereon, and furthermore comprising a link plate (7) mounted under said closure element, which is provided with a guideway in the form of link ribs (11) projecting from the link plate on either side thereof, around which the guide head engages, wherein said guide head is provided with two opposed grooves (20) being open in a direction towards each other, which function to receive the associated link ribs, **characterized in that** said grooves (20) taper off towards their lateral openings, at least on the upper side, in such a manner that each link rib (11) fits therein with some play at some distance from the lateral opening of the associated groove (20).

2. An open roof construction according to claim 1, wherein the upper sides of the grooves (20) extend obliquely in the direction of the lateral opening of the grooves, whilst the link ribs (11) have an at least substantially horizontal upper surface.
3. An open roof construction according to claim 1 or 2, wherein said grooves (20) diverge towards both ends, seen from a central portion.
4. An open roof construction according to any one of the preceding claims, wherein an elevation is formed on the guide head (15) in a central portion (21) of the guide head between the grooves (20), which elevation abuts against the underside of the link plate (7), in particular the link ribs (11) thereof.
5. An open roof construction according to claim 4, wherein said elevation on the guide head (15) is made up of a spring element (23).
6. An open roof construction according to any one of the preceding claims, including a second guideway comprising link ribs (12), which is present on the part (5) that is connected to the stationary part, wherein said guide head (15) is in engagement both with the first and with the second guideway.
7. An open roof construction according to claim 5 and 6, wherein said spring element (23) is provided both

between said guide head (15) and said first guideway (11) and between said guide head (15) and said second guideway (12).

8. An open roof construction according to claim 6 or 7, wherein the second guideway connected to the stationary part includes two spaced-apart link ribs (12) facing towards each other, wherein the spacing between said ribs is preferably larger than the joint width of the link ribs (11) of the link plate (7), and wherein preferably the guide head (15) fits between the link ribs (12) of the second guideway and includes grooves (19) facing away from each other, into which the link ribs of the second guideway extend.
9. An open roof construction according to any one of the claims 5 - 8, wherein said operating mechanism (4) is arranged for moving the closure element (3), such as a rigid panel, in vertical as well as in longitudinal direction, to which end the portion including the second guideway (12) is in the form of a link slide (5) which is capable of sliding movement in said guide rail.
10. An open roof construction for a vehicle having an opening (2) in its fixed roof (1), comprising a stationary part to be fixed to the roof, which includes at least one guide rail (6) extending in the longitudinal direction of the open roof construction, an adjustable closure element (3) supported by said stationary part, which is adjustable between a closed position, in which it closes the roof opening, and an open position, in which it releases the roof opening at least partially, as well as an operating mechanism (4) for adjustably supporting a vertically the closure element (3), which operating mechanism includes a driving element (18) capable of movement in said guide rail for driving a vertically adjustable part (16) having a guide head (15) present thereon, and furthermore comprising a link plate (7) mounted under said panel, which is provided with a first guideway (11) as well as a second guideway (12) formed on the part connected to said stationary part, wherein said guide head is in engagement both with the first and with the second guideway, **characterized in that** a spring element (23) is provided between said guide head (15) and between said first guideway (11) and/or between said guide head (15) and said second guideway (12).
11. An open roof construction An open roof construction for a vehicle having an opening (2) in its fixed roof (1), comprising a stationary part to be fixed to the roof, which includes at least one guide rail (6) extending in the longitudinal direction of the open roof construction, an adjustable closure element (3) supported by said stationary part, which is adjusta-

ble between a closed position, in which it closes the  
roof opening, and an open position, in which it  
releases the roof opening at least partially, as well  
as an operating mechanism (4) for adjustably sup-  
porting a vertically the closure element (3), which  
operating mechanism includes a driving element  
(18) capable of movement in said guide rail for driv-  
ing a part (16) having a guide head (15) present  
thereon, and furthermore comprising a link plate (7)  
mounted under said panel, which is provided with a  
in the form of at least one link rib (11), and prefera-  
bly with link ribs (11) projecting from either side of  
the link plate, around which the guide head  
engages, **characterized in that** said link plate is  
formed of sheet metal, on one edge of which a  
flange is formed, which is in encapsulated in plastic  
by means of an injection moulding technique so as  
to form said link ribs (11).

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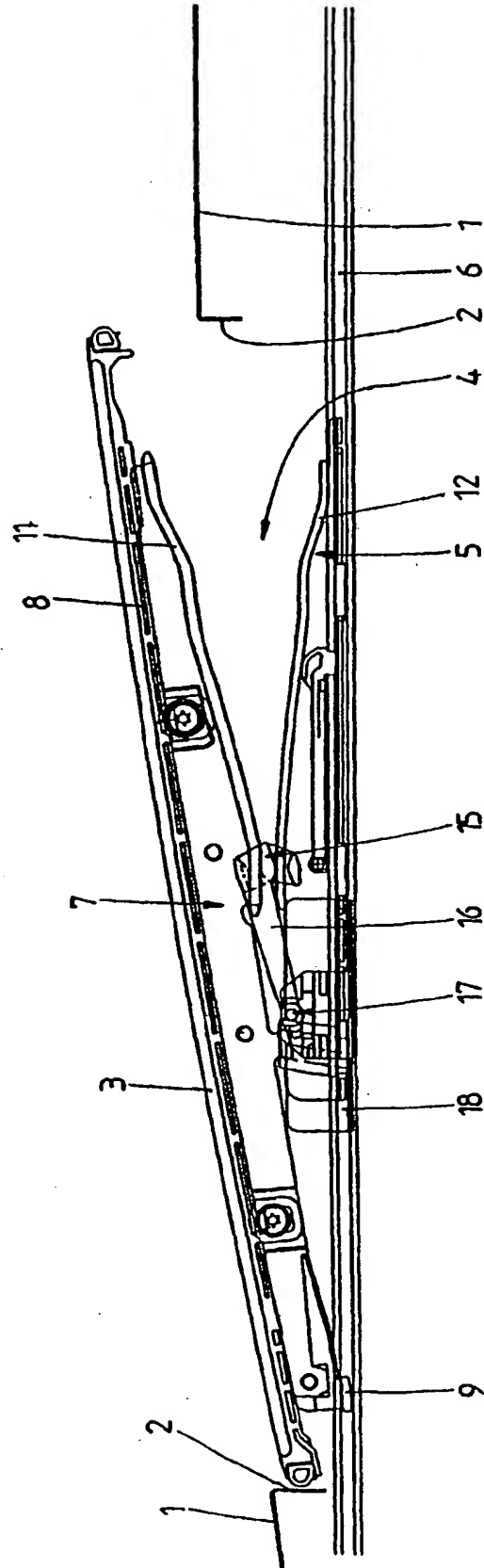


fig.1

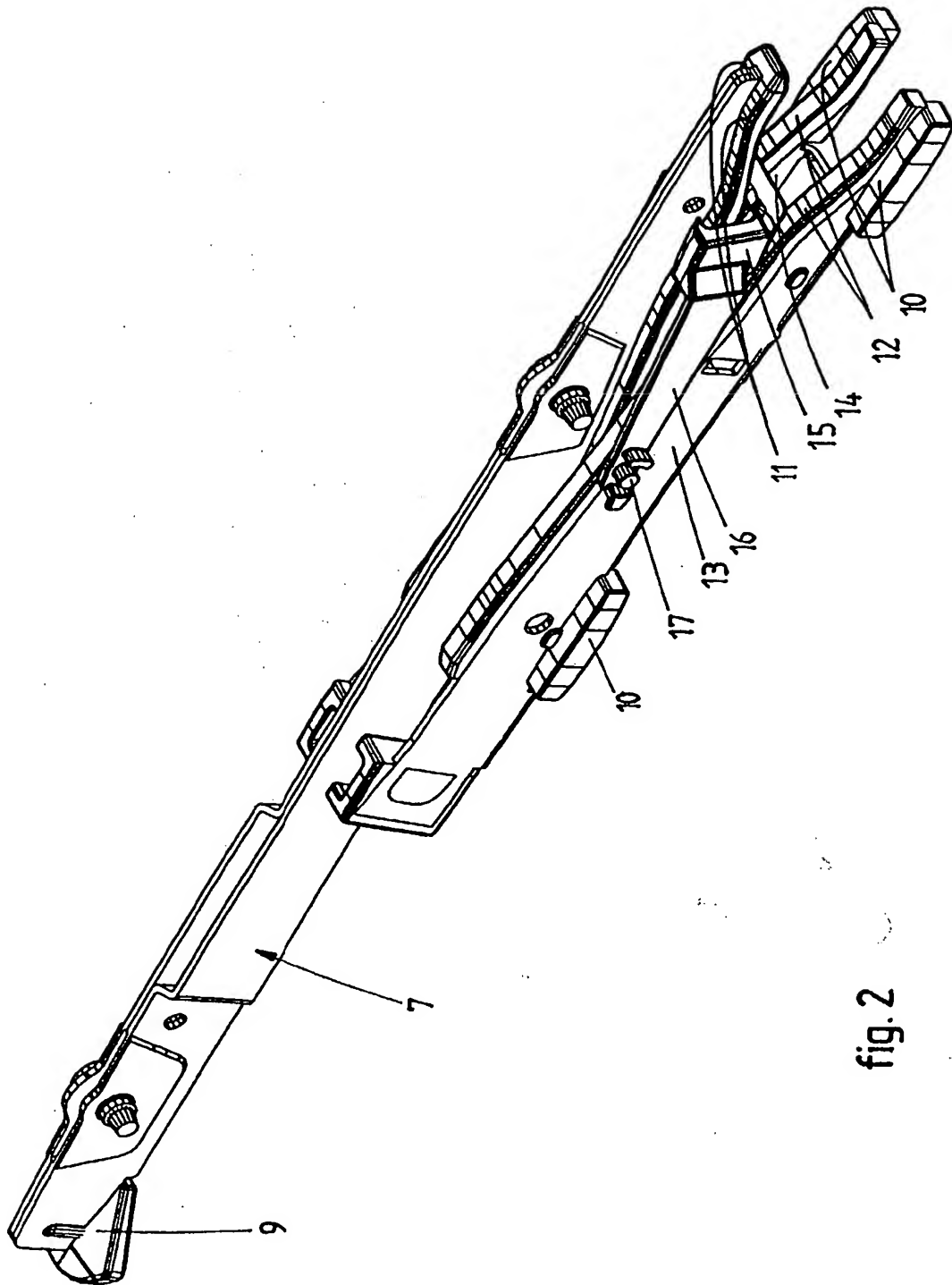


fig. 2

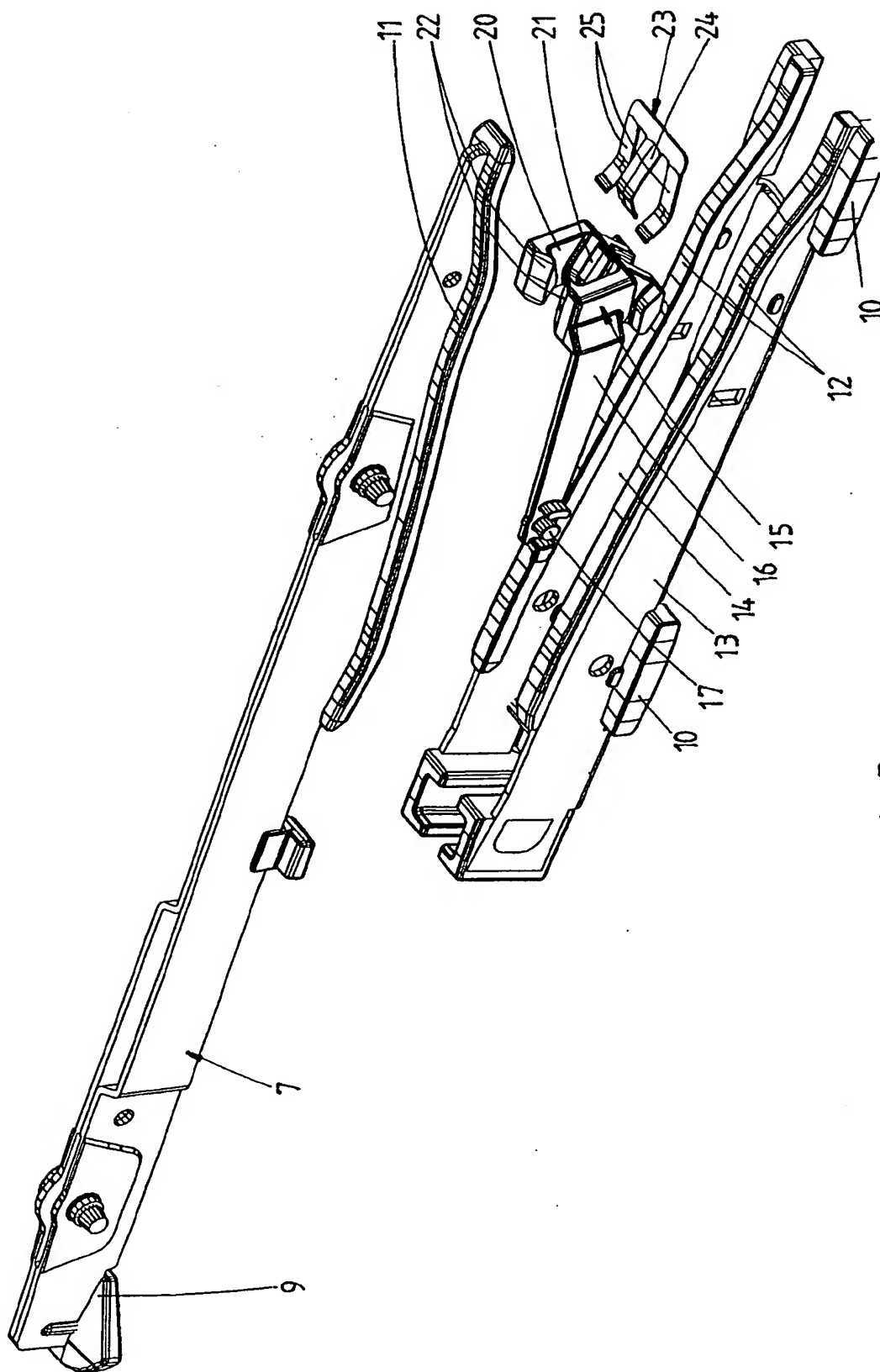
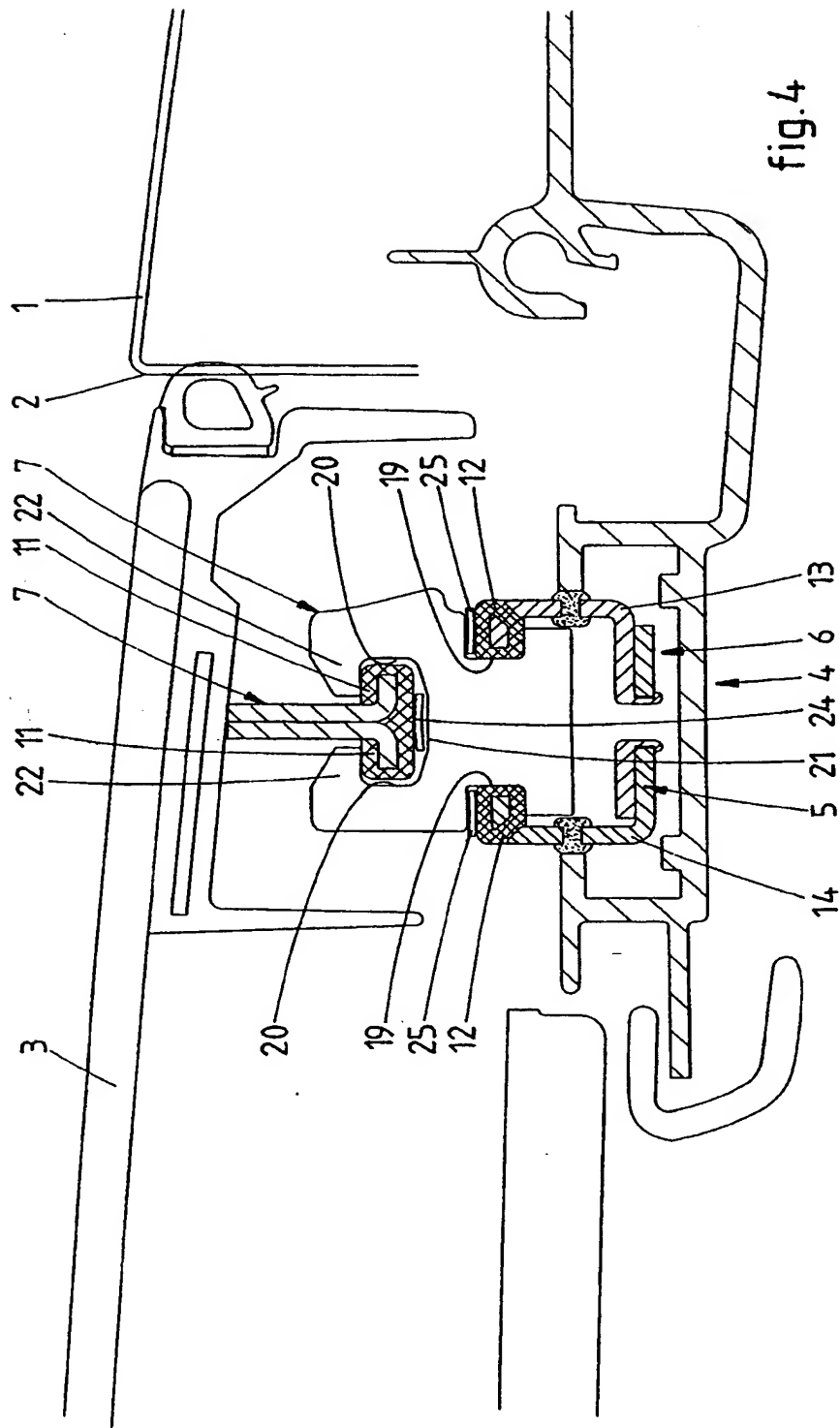
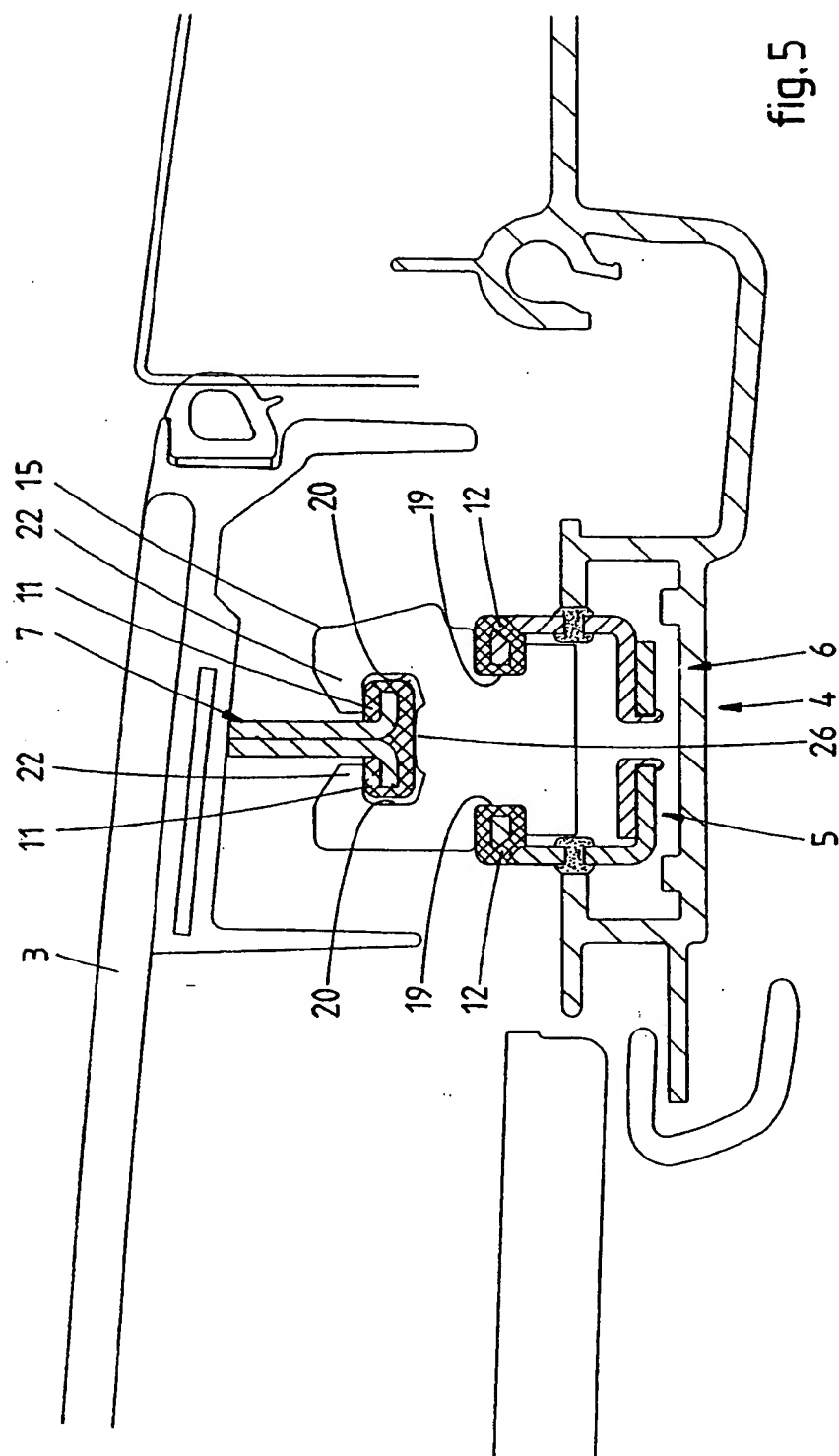


fig. 3









European Patent  
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# EUROPEAN SEARCH REPORT

Application Number  
EP 00 20 2266

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A	* the whole document *	10,11	
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B60J
Place of search		Date of completion of the search	Examiner
THE HAGUE		13 October 2000	Foglia, A
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**ANNEX TO THE EUROPEAN SEARCH REPORT  
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EP 00 20 2266

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
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